

The optimal functioning of the Control valve not only exists of sufficient body & seat tightness, but more important, the total "performance" of the valve and its controls! For an accurate and reliable working effect the valve body, actuator, positioner, regulators etc. most work in a strict harmony!

WHY TESTING...!?

Control valves are the final control elements in the operation of a continuously generating (petro) chemical process installation or power plant. Therefore the, plant efficiency is directly affected by non-performance of the valves, either in terms of output or in terms of reliability and availability.

Recent studies indicate that leaking or poor performing control valves only can reduce a power plant's output by up to 50 MW. While generally still 50-60% of the fugitive emission of industrial installations comes from its (control) valves, eliminating control valve problems alone can improve the heat rate of power plants in the range of 2 - 5%.

The modern continuously generating petrochemical- or power plant requires



that the control valves

provide both control and shut-off functions. Not only this dual role reduces capital expense, it also addresses the complexity of many control algorithms. Providing tight shut-off and control in one valve rather than two valves eliminates the need for two sets of logics to be embedded into the control system. The valves are also expected to maintain long term shut-off without leaking. Nevertheless many of these valves must operate under severe service conditions with high pressure and/or high temperature applications.



RESULTS OF IMPROPER MAINTENANCE & TESTING:

- ✓ Process controllability problems with the valve operating at lower openings.
- ✓ Poor shut-off capability, i.e. leakage through the valve under closed conditions, because of adequate actuator thrust, damage to the sealing surfaces caused by high velocities and improper calibration.
- ✓ Premature trim and body erosion.
- ✓ Poor dynamic response.

THE TYPICAL RESULTS OF CONTROL VALVE PROBLEMS ARE:

- ✓ Longer start up time.
- ✓ Loss in production capacity.
- ✓ Frequent maintenance.
- ✓ Occasional plant trips.
- ✓ Safety and environmental concerns (penalties for high risks or operations costs).
- ✓ Collateral damage to other expensive plant equipment.
- ✓ Lower unit availability and low flexibility.



Although plant designers treat them only as 'necessary evils', it is obvious that actuator-operated valves play a key role in the process quality and reliability and extreme care must be taken to avoid costly premature failures possibly resulting in substantial losses or plant shut-down. Besides the potential for improvement of reliability and efficiency, correct valve repair and testing also removes a major obstacle for the plants to operate for longer intervals.

Ventil manufactures a wide range of test units for testing and (re)adjusting all sorts of Globe-, Camflex-, and Waver type control valve according to the international test standards. The Ventil test units can be used for;

✓ SEAT LEAKAGE TESTING AND CLASSIFICATION

The seat leakage is tested with gas or liquid according to the international test standards. The most common applied test standard is FCI 70-2. Control valves class I – IV and VI are tested with gas. Class V with liquid (see schedule 1.2 and 1.3).



The seat leakage is measured on the in or outlet side by the digital, calibrated flow measuring system. The leakage (displayed in l/min, l/h, scfh or bubbles / min) is automatically compared with the standardised allowed leakage, followed by pass / fail signal.

✓ BODY TESTING

New valves and valves which have gone through a full reconditioning process need to be body's tested with liquid at 1.5 times the nominal working

pressure. Prior to the hydrostatic body or so called Shell test, the valve is completely filled by tilting the clamp or by a 'vacuum – filling' system. Visual inspection and/or a pressure decay method is used to proof the body integrity.

✓ STROKING THE TRIM

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The functionality of the controls is tested and adjusted according to the manufacturers specification or specific process circumstances. The Valve is operated to the open-/close position by operating the actuator and/or positioner with external signals, usual 0 – 21 mA / 0-20 PSI / 0-100 PSI. Specific software for digital positioners can be applied.



IMPORTANT FEATURES

Quick clamping

The most important feature of the Ventil test unit is the quick clamping system. A variety of features is available;

- ✓ Horizontal (stem vert.), vertical (stem hor.) or tilting clamping system.
- ✓ ½ - 86" / DN15 – 2200 mm.
- ✓ 1 – 2000 ton's.
- ✓ Clamping on the inlet flange, both flanges or (proportional clamping) between the clamping tables.



Horizontal, clamping on inlet flange only



Tilting.



Vertical liquid filling and testing.

Test- & operation systems

The standard test unit contains the following test systems;

- ✓ Low pressure gas (compressed air) test system 0-10 bar / 145 PSI.
- ✓ Seat leakage measuring system 0 – 1000 l/min. / 2100 scfh.
- ✓ Seat leakage measuring 0 – 50 bubbles / min.
- ✓ 0 – 21 mA, 0-20 PSI (2 bar), 0-100 PSI (7 bar) for testing and setting the controls.

A variety of additional low and high pressure gas and liquid test systems is available on request.



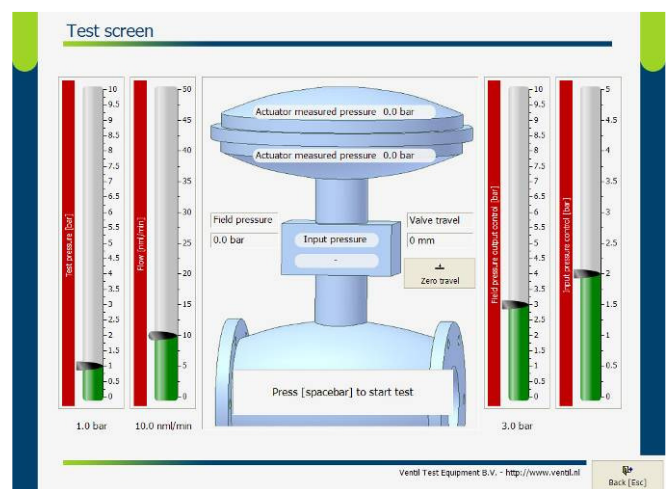
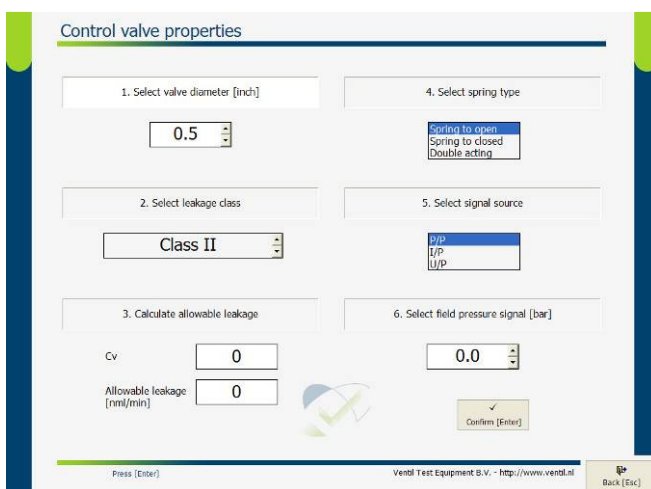
Range, Set up and Configuration

Standard ½ – 10", but any range in size, leak rate and pressure class can be accommodated on client specification. Ventil only uses the best components and materials, designed for continues use and a long and reliable working effect.

Digital reading, registration and certification

Although full analogue and manual operated systems are still available, the majority of the Ventil test units for Control valves are completed with the unique CRS (Computer Registration System). The Windows XP operated system is specially designed for work shop use. It features a very simple operation and has a variety of unique functions.

Prior to the test, the operator selects the valve type, size and controls. The operator can then adjust the controls to simulate the practice circumstances or adjust the controls according to the manufactures standards.



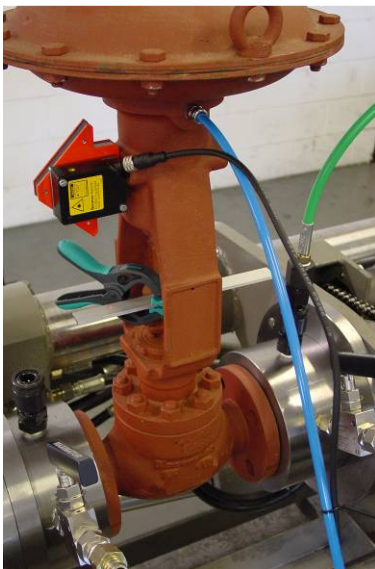
Valve production or repair

For the valve repair shop the test units, controls and operation will have a very universal character. For approving and setting the newly manufactured valve after production, a higher grade of automation and standardisation can speed up the process and improve reliability of the test results.



AVPS

The AVPS system is an optional feature on all Control valve test units. The computer operated system enables you to run a variety of test and accurately detect and measure the performance of the valve controls. Standard test procedures are:



Dynamic scan

The typical test on a common diaphragm control valve is the automatic dynamic scan which ramps the operational input signal from its minimum operating point (normally 4 mA) to its maximum operating value (typically 20 mA), and then reverse the signal and ramp back to the starting point.

The signal will pause at the peak value and pause again at the minimum value to allow the valve to stabilize before reversing the signal or ending the test.

Guidelines for selecting the ramp speed are selected in the software. During the time that the signal is being controlled, the software collects data on the active channels assigned; the input signal ramp and travel. The standard graph on the screen offers clear information on what the typical valve should indicate if it is in a good condition. The graph created from the test, plots the input signal and valve travel, giving a picture of the overall valve performance.

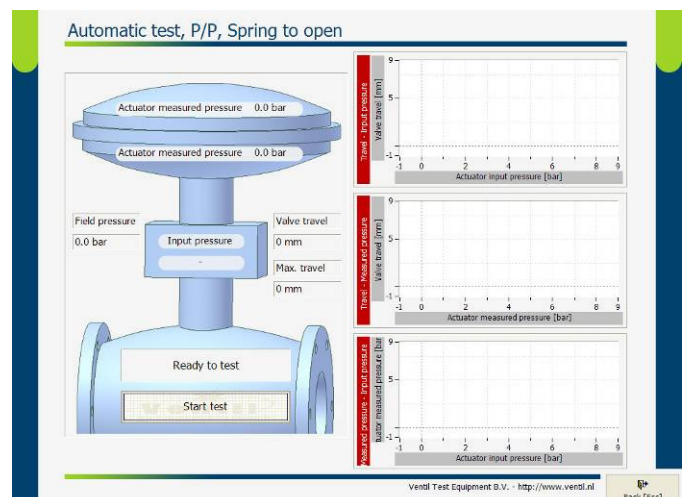
The system documents the overall calibration, travel, linearity and 'dynamic error band'.

B) Step test

The 'step test' is similar to the dynamic scan, but instead of a linear input signal the valve is now opened and closed in a certain amount of pre-programmed steps. For example 4 – 8 – 12 – 16 – 20 mA. On the screen the AVPS software program draws graphics of the input signal (mA or compressed air) and the reaction (output) of the valve. This system is suitable for DA, NO and NC).

C) Dump test

With the 'dump test' the valve is opened or closed within a minimum programmed setting. The maximum input signal is programmed and the reaction of the valve is shown on the screen.



Schedule 1.1

Standardised test pressures for valves

RATING	BODY TEST PRESSURE (minimum)		SEAT TEST PRESSURE (minimum)	
	bar	PSI	bar	PSI
CLASS 150	29.4	427.5	21.6	313.5
CLASS 300	76.7	1110	56.2	814
CLASS 600	153.2	2220	112.3	1628
CLASS 800	207	3002	152	2204
CLASS 900	229.8	3330	168.5	2442
CLASS 1500	383	5558	280.8	4076
CLASS 2500	638	9255	468	6787

Important remark referring to schedule 1.1:

- Class 800 pressures are taken from BS5146
- API pressures are taken from API6A, All other pressures are taken from ANSI16.34, relevant to Carbon steel ASTM A 216 Gr WCB.
- There may not be exact equivalence between pressures in bar and PSI due to rounding.
- This chart gives the minimum test pressures per pressure class; see actual standards for specific information.

Schedule 1.2

Maximum Allowable Seat leakage Control valves:

Leakage Class	Maximum Seat leakage	Test medium	Test pressure	Test procedure
Class I	No test required provided user and supplier to agree
Class II	0.5% of rated valve capacity	Air or Water at 50-125 °F (10-52 °C)	45-60 Psi. or max. operating pressure whichever is lower	Pressure applied to the valve inlet with the outlet open to atmosphere or connected to a low head loss-measuring device. Full normal closing thrust provided by actuator
Class III	0.1% of rated valve capacity	As above	As above	As above
Class IV	0.01% of rated valve capacity	As above	As above	As above
Class V	5x10 ⁻¹⁰ ml. of water per min. per Inch of orifice diam. per Psi. differential.	Water at 50-125 °F (10-52 °C)	Maximum differential pressure	Pressure applied to valve inlet after filling the entire body cavity and connected piping with water and stroking valve plug closed. Use net specified max. actuator thrust, but no more, even if available during test. Allow time for leakage flow to stabilize.
Class VI	Leakage per paragraph below	Air or Nitrogen at 50-125 °F (10-52 °C)	50 Psi. or max. operating pressure whichever is lower	Actuator should be adjusted to operating conditions specified with full normal closing thrust applied to valve plug seat. Allow time for leakage flow to stabilize and use suitable measuring device

Schedule 1.3

Maximum Allowable Seat leakage Control valves Class VI:

Nominal port diameter		Allowable leakage	
Millimetres	Inches	ml per min.	Bubbles per min.
25	1	0.15	1
38	1½	0.30	2
51	2	0.45	3
64	2½	0.60	4
76	3	0.90	6
102	4	1.70	11
152	6	4.00	27
203	8	6.75	45



CONTROL VALVE TESTING

DEFINITIONS

Control valve:

A valve with a power positioning for moving to closure member to any position relative to valve port or ports in response to and in proportion to an external signal. The energy for a control valve actuator is derived from a independent source.

Actuator:

A powered valve operator use to open or close a valve; energized by pneumatic, electric, or hydraulic power sources.

Bubble tight:

A typical requirement for manufacturer's production test meaning no visible seat leakage when tested on gas (bubbles of air).

Rated travel:

The valve travel at which the manufacturer's rating is established.

Rated valve capacity:

The quantity of test fluid (air or water) that would pass through the valve at rated travel under the stated pressure conditions as determined by the appropriate equations and manufacturer's ratings.

Seat leakage:

The quantity of test fluid passing through an assembled valve in the closed position under the test conditions as defined.

Trim:

Internal components associated with isolating or regulating the flow. Includes seating surfaces, closure members (gate, disk, ball, plug, etc.) stem, bearings, guides, and associated parts.

Text, design and layout by Arthur Baars.

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